STATE OF MONTANA
MONTANA DEPARTMENT OF TRANSPORTATION
JOB PROFILE

☐ Update

☑ Formal Review

Date Submitted June 21, 2013

SECTION I - Identification

Working Title: Pavement Design Engineer

Department: Transportation

Job Code Number: 005607

Division & Bureau: Engineering/Materials

Job Code Title: Civil Engineering Specialist

Section & Unit: Pavement Analysis/Pavement Engineering Unit

Pay Band: 7

Work Address: Helena

Position Number: 40072

Phone:

☐ FLSA Exempt ☑ FLSA Non-Exempt ☑ Non-Union ☐ MPEA ☐ Blue Collar

Profile Completed By: Daniel Hill

Work Phone: (406)444-3424

Work Unit Mission Statement or Functional Description:
The Materials Bureau is part of the Engineering Division of the Montana Department of Transportation (MDT). One of the Bureaus responsibilities is to develop and implement comprehensive pavement data collection, testing, and analysis programs that facilitate pavement project selection and pavement surface and subsurface design. These activities help officials select projects and provide information for short and long-range engineering and construction programs. The Bureau consists of the Geotechnical Section, Physical Testing Section and Pavement Analysis Section.

The Pavement Analysis Section's mission is to gather, arrange, and analyze pavement data in a competent, precise and purposeful manner and to provide suitable and cost effective pavement designs and treatments for rehabilitated roadways statewide. The Section collects pavement distress information, existing roadway pavement and geotechnical information, current and future traffic, roadway plans and uses pavement falling weight deflection (FWD) data to determine feasible treatment alternatives. A variety of treatments ranging from short-term to total reconstruction may be considered depending on roadway type and condition. All alternatives are subjected to cost analysis. A central element of the Section's function is to provide service to its internal and external clients in the form of pavement analysis products. These products range, from detailed management Section treatment reports to university research, and characterize a broad range of topics and disciplines, both internal and external to MDT.

The Section develops, maintains, and administers complex, comprehensive pavement data collection and engineering analysis programs and maintains comprehensive pavement condition, deflection, and materials databases. This database is used in highway design, highway maintenance, transportation planning, safety, materials, federal certification, university research, and allocation and distribution of maintenance funds and federal highway funds in accordance with statutory funding formulas. The

Section maintains and/or administers several elements of the MDT Project Management System (OPX2), Pavement Management System (PvMS), AASHTO Pavement Design System, Nondestructive Testing Program, Local Transportation Assistance Program (LTAP), University Research Program, and Long Term Pavement Performance (LTPP) database.

The Section is also responsible for providing information and analysis for external customers such as Federal Highways, Federal Forest Service, Federal Park Service, and Montana County and Local governments in the areas of pavement design, management, and research. The Section evaluates special studies and plans, provides executive management with information to make complex, potentially controversial decisions regarding pavement project selection, pavement design, and pavement maintenance. The section is responsible for the statistical accuracy of reports to MDT executive management, Divisions, and external customers.

The Pavement Engineering Unit performs professional pavement engineering; field and laboratory investigations; and pavement analysis, evaluations, and problem solving. The Unit collects, compiles, and analyzes information, prepares and writes reports, including engineering contract plan drawings and specifications, and provides recommendations related to pavement engineering such as stabilization, drainage designs and modifications, and other issues. Work encompasses planning, pre-construction, construction, and maintenance phases of the highway program.

Describe the Job's Overall Purpose:

The Pavement Engineering Unit performs professional pavement engineering; field and laboratory investigations; pavement analysis, evaluations, and problem solving. The Unit collects, compiles, and analyzes information, prepares and writes reports, including engineering contract plan drawings and specifications, and provides recommendations related to pavement engineering such as, stabilization, drainage designs and modifications, design alternatives, treatment recommendations, materials performance, and other issues. Work encompasses planning, pre-construction, construction, and maintenance phases of the highway program.

This position is responsible for the planning, development, and management of project and network level pavement analysis and design within the Section and to supervise, train and work with engineers to design rehabilitation projects and review completed projects to assure accuracy. This involves managing the professional and technical engineer staff of the Unit; administering pavement design and evaluation policies; recommending internal organization and reporting policies and procedures; determining and recommending necessary engineering resources and data; monitoring pavement designs and services to ensure accurate and efficient performance.

This position provides professional pavement engineering investigation, analysis, and determination of appropriate pavement designs used for major statewide highway construction projects. The incumbent plans and directs pavement engineering investigation and analysis activities to determine appropriate pavement designs; provides research and technical assistance to Department staff, contractors, local and federal governments, and others; and performs a variety of other duties as assigned by the section supervisor.

SECTION II - Major Duties or Responsibilities	***% of Time***
PAVEMENT ENGINEERING ANALYSIS, DESIGN AND RESEARCH	**55%**

This position provides advanced professional engineering analysis and design services for all pavement aspects of Department road and bridge construction projects. The incumbent evaluates overall project purpose and requirements to determine pavement issues and impacts; establishes analytical procedures and conducts technical analyses; develops alternatives and approaches to complex

pavement and materials problems; develops comprehensive reports to present findings and recommendations; assesses, modifies, and/or approves plans and analyses developed by subordinate staff; and attends and conducts reviews and conferences to discuss, coordinate, and develop solutions to pavement analysis and design problems.

Serves as a Department authority in pavement engineering, design and evaluation (e.g. subgrade evaluation, materials performance analysis, pavement design, lab test analysis, resilient modulus evaluation or mechanistic analysis). Conducts and coordinates complex pavement engineering projects to determine the most appropriate pavement designs for major highway construction projects. Develops comprehensive pavement engineering reports; performs and coordinates field surveys; investigations and laboratory testing; evaluates and analyzes pavement deflection test data; evaluates bound and unbound materials and dynamic and static performance and test characteristics; dynamic modeling and testing of the traffic/pavement structure system, rigid and flexible pavement responses; analyzes and evaluates proposed pavement structures; analyzes elastic, viscoelastic, and plastic properties, and how these factors vary under extreme climatic conditions; determines the most appropriate structural and sectional properties for specific pavements; evaluates costs of proposed pavement alternatives; designs and conducts a variety of engineering studies; develops solutions to a broad range of pavement design problems; and evaluates investigation and testing procedures. The position continually researches and evaluates new standards, emerging technologies, developmental methods, and other innovations within the specialized area of expertise to maintain technical authority and devise means for integrating significant developments into Department practices.

Develops alternatives and innovative approaches to complex pavement problems (e.g., unexpected site or environmental conditions, design flaws, aesthetic problems, gravel vs. cement treated base, heavy vs. light road volumes, binder selection, etc.). Ensures conformance with engineering and design standards. Identifies errors and deficiencies; determines the need for additional analysis or design modifications; ensures that designs reflect project needs, standards, timelines, and cost parameters; and provides initial approval. Develops and incorporates value engineering alternatives that meet project requirements while minimizing costs. This involves advanced engineering design, research, and coordination among various department work units to identify and resolve engineering deficiencies.

Analyzes and evaluates field survey data to determine the overall condition of roadway materials and the nature, severity, and causes of materials failure and/or endurance. Investigates ongoing construction projects for altered conditions to determine whether surfacing designs must be recomputed and provides recommendations for appropriate revisions to surfacing designs in accordance with all applicable materials design standards and specifications.

Participates in plan-in-hand meetings to provide recommendations and comments and to compile information related to design changes or additions. This involves tracking comments and suggestions from meeting participants, providing comments regarding materials design alternatives, incorporating this information into reports or memoranda, and coordinating design changes with the appropriate work units. This involves providing expert advice on pavement engineering issues, resolving discrepancies and differing views, and attaining agreement or consensus on design solutions to pavement design problems. Presents and defends new research findings, initiatives, alternatives, and other developments related to MDT's pavement engineering function.

Compiles and evaluates complex soils, materials, traffic, pavement deflection and distress data, and materials costs required for pavement analysis and design to determine the optimum materials (e.g., gravel, cement-treated base etc.) and design strategy (e.g., repair or resurface). This involves reviewing data in terms of impact on other parts of the project, taking into consideration such factors as cost-efficiency, type of project, location/topography, current condition, durability of various materials based on prior projects, available right-of-way, and other engineering and design considerations.

Utilizes MDT's Pavement Management System to retrieve and analyze pavement conditions, surface and subsurface distress, and pavement performance data. Maintains an inventory of pavement information including historical pavement design information.

This position provides research and technical assistance services to Department staff, contractors, local and federal governments, and others. The incumbent designs and conducts special pavement-related research projects; provides emergency responses to crisis engineering problems; provides on-site and remote pavement engineering expertise and technical assistance to a variety of individuals and organizations; researches and monitors changing methods, technologies, and professional standards in pavement engineering and materials testing; and develops and presents reports on new pavement design and construction techniques. These duties require knowledge of the concepts and theories of engineering; engineering survey, investigation, and testing methodologies; complex engineering analysis principles and techniques; highway geometry; FWD and NDT data gathering methods and techniques; highway economic, safety, and efficiency issues; advanced research methods and techniques; and applicable State, Federal, AASHTO, and FHWA requirements and standards. This work also requires the ability to translate complex data to individuals of varied technical levels and establish and maintain effective working relationships with contractors.

PROJECT MANAGEMENT **30%**

Manages pavement analysis and design projects for the Department to ensure the overall quality and cost-effectiveness of surfacing designs used for all statewide construction and rehabilitation projects. Evaluates current and projected workflow, relative complexity of designs (e.g., gravel vs. cement treated, heavy vs. light road volumes, etc.), and available resources to determine design priorities, staff/consultant assignments, and project guidelines. Monitors projects to measure progress, resolve problems, and ensure timely delivery of major design projects.

Reviews project nominations, design proposals, field notes, correspondence, reports, and related documentation to identify appropriate information for inclusion in the basic surfacing design plan. Evaluates the physical characteristics of the site in context of construction standards to identify the geometrics and determine survey information needed through site review. Identifies design problems and alternatives to improve safety and ensure projects comply with current standards.

Directs and oversees the work of professional and technical engineer staff and consultants involved with pavement analysis and design projects to ensure the overall quality of work procedures and products as well as compliance with the terms and conditions of individual agreements. This involves explaining and monitoring project needs, Department procedures and standards, and contract requirements; reviewing work products and resolving technical or procedural problems; and reviewing and approving claims and payments based upon contract delivery.

Serves as a Department technical authority in pavement design principles and applications by providing advanced technical assistance, serving on various research and planning workgroups, and responding to complex issues referred by other Bureaus, Districts, and consultants on various aspects of pavement design. Because all pavement design work originates in the Department's centralized offices, the position serves as a critical technical resource for District staff and management as well as Helena personnel on the most complex aspects of pavement design.

Analyzes and evaluates designs developed by staff and consultants to ensure consistency, constructability, and conformance with engineering and design standards. Identifies errors and deficiencies; determines the need for additional analysis or design modifications; ensures that designs reflect project needs, standards, timelines, and cost parameters; and provides initial approval. Evaluates and incorporates value engineering alternatives that meet project requirements while minimizing costs.

Provides ongoing quality assurances for design procedures and products to develop new approaches to various design needs and impediments, resolve process deficiencies (e.g., communication, technologies, etc.), and recommend procedures and standards that promote quality, efficiency, and cost-effectiveness.

Utilizes the Department's project management software (OPX2) to monitor pavement design activities to ensure activities are completed on time and do not delay other project activities along the critical path.

SUPERVISION AND STAFF DEVELOPMENT 10%

This position manages technical and professional staff, establishes work plans, priorities, and procedures; developing and recommending overall responsibilities and allocation of staff; coordinating assignments through subordinate workers; handling disciplinary actions and resolving conflicts; and hiring and training staff as necessary. The position is responsible for determining duties and responsibilities of subordinate positions and evaluating performance. This work requires knowledge of Department of Transportation and State of Montana personnel procedures and policies, employment law, unions, program requirements, and personnel management practices and techniques; directing, organizing, and coordinating multiple staff; effective written and verbal communication skills; and skill in the use of standard office software applications for correspondence, scheduling, information management, and other tasks. These duties also require the ability to direct and motivate staff toward common goals and objectives.

Directly supervises professional engineering and technical staff within the work unit by reviewing and revising overall work plans, priorities, and procedures and monitoring progress through meetings and consultations. Conducts meetings, disseminates data, and promotes information exchange for support and advancement of office and Department goals.

Determines training needs of professional staff through analysis of program effectiveness; new pavement engineering procedures, specifications, and policies; evolving technologies; and staff performance. Prepares, presents, or coordinates training through personnel specialists, training offices, or outside consultants to ensure that modern technologies and operational strategies are available.

Identifies staffing needs, recruits and hires employees, and allocates staff to adequately support ongoing pavement analysis and design operations and activities. This involves ensuring compliance with State and federal employment and civil rights laws throughout the hiring process, assigning personnel screening and selection committees, reviewing results and making final recommendations for hiring, and ensuring proper training and orientation of new employees.

Evaluates the performance of positions directly supervised and completes performance evaluations. Recommends, implements, and monitors corrective actions. Enforces disciplinary policies to ensure consistency in the application of disciplinary actions.

Ensures that staff complies with State and Department personnel rules, regulations, and policies. Resolves grievances at the lowest level whenever possible

OTHER DUTIES 5%

This position performs a variety of other pavement engineering, research, and design duties as assigned in support of the MDT mission and Bureau goals. This includes representing the Department and/or Bureau at conferences and meetings, directing special projects, attending ongoing education and training, and performing a variety of other duties as directed.

Give specific examples of the types of problems solved, decisions made or procedures followed when performing the most frequent duties.

As a pavement authority for the Department in pavement engineering applications, the position is expected to determine the nature and scope of the most complex pavement design problems; determine optimum methods, procedures, and tools for addressing site-specific and project sensitive issues; and develop and approve pavement designs for major construction projects. Problems may involve material selection, material performance, subgrade evaluation, right of way limitations, constructability, value engineering and geometrics; availability of project resources (e.g., equipment, workforce, funding, etc.); environmental, geological, and related scientific features; new engineering standards and project requirements; and logistical issues (e.g., location, timelines, etc.).

The position is also responsible for researching, assessing, and incorporating developmental methods, standards, and technologies into Department pavement engineering practices to promote the delivery of state-of-the-art pavement services for statewide projects. These considerations must be balanced with District priorities as well as statewide pavement guidelines and policy.

Identify potential pavement problems early in the project design process and implement a plan to define the situation and provide an engineered solution in a timely fashion. Commit Department resources to the project as needed.

Prioritizes workload through the use of the project management system, knowledge of project specific requirements and input from other district project management personnel. Estimates project demands and projects short and long-term resource needs.

Writes pavement related construction specifications and special provisions for new or innovative pavement technologies as needed. Follows up on these specifications to adjust specifications as needed based on construction information as it becomes available.

What do you consider the most complicated part of the job?

The most complicated aspect of the position involves assessment of specialized pavement engineering features, pavement and materials performance, and developing optimum methods, procedures, and tools for addressing site-specific and project sensitive issues. As an authority and Department expert in pavement engineering applications, the position is responsible for addressing the most complex professional pavement engineering issues associated with pavement engineering. This includes researching and proposing new methods and practices for statewide adoption, developing innovative approaches to pavement design problems, and incorporating new standards and technologies into Department operations. The position must balance these considerations with individual District and Department priorities and requirements.

What laws, regulations, guidelines, manuals or other written established procedures are available to the incumbent?

Available pavement engineering policy, regulations, guidelines, manuals, and/or procedures include State, Federal, AASHTO, FHWA, Asphalt Institute, American Concrete Pavement Association requirements and standards; Montana Materials Manual, Construction Manual, Traffic Engineering Manual, Standard Specifications for Road and Bridge Construction, and a variety of other specialized engineering manuals and documentation. In most cases, the position is responsible for establishing project procedures and priorities to ensure the overall quality and timeliness. Much of the position's work involves the research and analysis of project data and specifications for which no established guidelines or conclusions are provided.

1. ***The following duties and/or specific tasks listed under section II above are considered "essential functions" because they require specialized expertise and skill and are the primary reasons the job exists (they must be performed by this position with or without accommodations):***

Duty A: Pavement Engineering, Research, and Design
Duty B: Pavement Project Management
Duty C: Supervision

The following mental and physical demands are associated with these essential functions:

PHYSICAL

- Ability to walk over uneven terrain
- Remaining seated for extended periods of time, with occasional walking; standing; bending
- Operating a personal computer
- Communicate in writing, in person, and over the phone

MENTAL

- Ability to multi-task
- Demands for accuracy in all aspects of work
- Ability to meet inflexible deadlines
- Decision making that affects public health and safety
- Computing arithmetic operations
- Comparing data
- Compiling information
- Analyzing
- Coordinating
- Synthesizing
- Instructing

Predominant work is performed in a normal office environment and in the field, involving:

- Exposure to extreme weather
- Exposure to high temperature substances
- Exposure to high-speed traffic

2. ***Does this position supervise others?*** ☑ **Yes** ☐ **No**

Number directly supervised: 3
Position Number(s) of those supervised: 40046/B6, 40048/B6, 40045/B6

3. ***Attach an Organizational Chart.***

SECTION III - Minimum Qualifications - List minimum requirements for the first day of work.

Critical knowledge and skills required for this position:

KNOWLEDGE: This position requires extensive knowledge of the concepts and theories of engineering, geology, mathematics, the physical sciences, and highway and bridge design; methods and practices of highway construction and construction engineering; engineering policy; materials properties, specifications, and test methods; and construction safety practices. The position also requires thorough knowledge of contract law and contract administration, traffic engineering; highway economic, safety, and efficiency issues; Engineering Division objectives and Materials Bureau goals; project planning; research methods and techniques; State, federal, AASHTO, and FHWA requirements and standards; project specifications; Montana Materials Manual, Construction Manual, Traffic Engineering Manual, Standard Specifications for Road and Bridge Construction, and a variety of other specialized engineering manuals and documentation; highway construction methods and techniques; transportation planning, design, and highway construction processes; field applications of highway engineering and construction; environmental rules and regulations; and construction methods and practices.

SKILLS: This position requires skill in reading and interpreting complex plans, specifications, and contract documents; project management; drawing conclusions and making recommendations; assessing construction plans and projects; communication and negotiation; developing and administering a variety of diverse projects and functions; and developing solutions for complex problems.

Pavement engineering requires the operation of specialized computer applications and an understanding of information and data management. It is expected that the incumbent will have fundamental computer skills that will enable them to easily learn specialized applications.

Behaviors required to perform these duties:

- **Leadership:** Provides clear directions, technical assistance, and guidance to District and Department staff, contractors, consultants, and others to ensure effective operations and project activities. Motivates subordinate staff and coworkers to achieve common objectives. Appropriately delegates responsibilities to competent staff.

- **Analytical/Interpretive Thinking:** Accurately applies new research findings, technical analyses, new methods and technologies, engineering standards, and project requirements to specific circumstances.

- **Decision Making:** Evaluates multiple factors to resolve problems. Develops technically and legally defensible courses of action in response to complex or ambiguous pavement engineering issues; research conclusions and recommendations; and project management problems.

- **Achievement:** Achieves goals and brings projects to completion. Persists and stays focused when faced with a series of challenging or uncertain situations. Demonstrates a concern for working well or for competing against a standard of excellence.

- **Independence of Action:** Determines appropriate responses to pavement project, design and evaluation problems and opportunities with minimal assistance or precedent

Education:
Check the one box indicating minimum education requirements for this position for a new employee the first day of work:

- ☐ No education required
- ☐ High school diploma or equivalent
- ☐ 1-year related college/voc. training
- ☐ Related AAS/2-years college/vocational training
- ☐ Related Bachelor's Degree
- ☑ Related Master's degree

Please specify the acceptable fields of study:

Civil engineering, engineering geology, or a directly related engineering field.

Other education, training, certification, or licensing required:
Certification as a Professional Engineer (PE) is required. This position reviews, approves, and signs engineering, pavement designs and analyses on behalf of the Department.

Experience:

Check the one box indicating minimum work-related experience requirements for this position for a new employee the first day of work:

- ☐ No prior experience required
- ☐ 1 year
- ☐ 2 years
- ☑ 3 years
- ☐ 4 years
- ☐ 5 or more years

Other specific experience:
Three (3) years of pavement, geotechnical or materials engineering experience, of which one year is supervisory experience. Credit for supervisory experience may be considered for each year spent in a leadership role or from specific leadership/management training. Certification as a PE is required.

Pavement analysis, design, geotechnical or materials engineering experience directly related to highway engineering is preferred.

Alternative Qualifications:
This agency will accept alternative methods of obtaining necessary qualifications.

☑ Yes ☐ No

Alternative qualifications include*:*

Equivalent combinations of education and experience will be considered on a case by case basis. An additional two (2) years of progressively responsible civil or pavement engineering experience may substitute for a master's degree (e.g. a bachelor's degree and five (5) years of progressively responsible pavement, geotechnical or materials engineering experience). Related civil or structural engineering experience may (and will be evaluated on a case by case basis) substitute for a portion of the required engineering experience.

SECTION IV – Other Important Job Information

☐ Fingerprint check

☑ Valid driver's license

☐ Background check

☐ Other; Describe

This position travels throughout the state to review projects, plan field investigations, monitor field investigations, and attend meetings. Travel is estimated to be less than 1000 miles per month. Fieldwork is performed on planned projects and on active construction projects. It requires the ability to walk over uneven terrain and to work in proximity to heavy equipment and high-speed traffic.

SECTION V – Signatures

Signature indicates this statement is accurate and complete.

Employee:

Name: _____ Title: _____

Signature: _____ Date: _____

Immediate Supervisor:

Name: _____ Title: _____

Signature: _____ Date: _____

Bureau Chief:

Name: _____ Title: _____

Signature: _____ Date: _____

Division/District Administrator:

Name: _____ Title: _____

Signature: _____ Date: _____

Department Designee:

Brent Rabe/Designee

Human Resources Administrator
Human Resources Division

Signature: _____ Date: _____